CHAPTER 4 – CULTURE AND LEADERSHIP
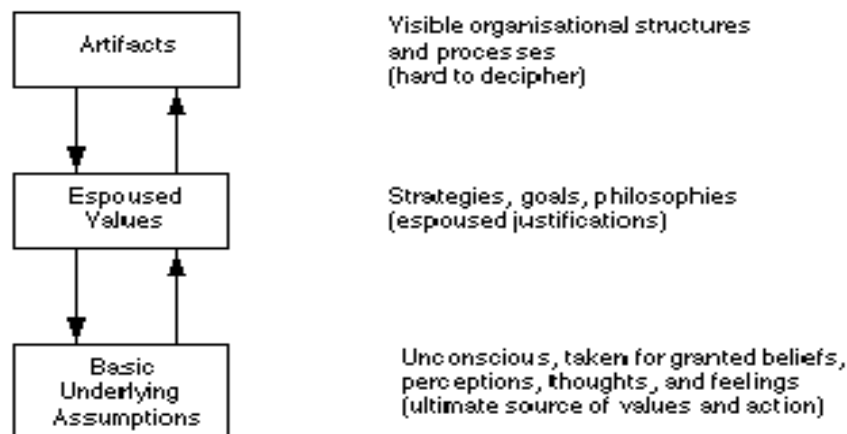
ORGANIZATIONAL CULTURE

Dr. Edgar Schein is generally credited with inventing the term "organizational culture." The simplest way of thinking about organizational culture is to liken it to personality and character in the individual. As we grow up we learn certain ways of behaving, certain beliefs and certain values that enable us to adapt to the external realities that face us and give us some sense of identify and integration. As organizations grow and succeed, they undergo the same kind of learning process. What are initially the beliefs and values of the group's founders and leaders gradually become shared and taken for granted if the organization is successful in fulfilling its mission and managing itself internally. It is the past history of success that makes cultural beliefs and values so strong. As organizations grow and age they also develop sub-units, and the learning process described here occurs in these sub-units as well since they have different tasks and different issues of internal integration.[1]

Schein suggests that organizational culture can be considered in three layers as shown in the following figure.

Levels of Culture

Schein's organizational model illuminates culture from the standpoint of the observer, described by the three levels as shown above. At the first and most cursory level are artifacts (*organizational attributes)* that can be seen, felt, and heard by the uninitiated observer. Included here are facilities, offices, furnishings, visible awards and recognition, the way its members dress, and how each person visibly interacts with each other and with organizational outsiders.

The next level deals with the espoused values (*professed culture)* of an organization's members. Here, company slogans, mission statements, and other operational creeds are often expressed, and local and personal values are widely expressed within the organization. Organizational behavior at this level usually can be studied by interviewing the organization's membership and using questionnaires to gather attitudes about organizational membership.

At the third and deepest level, the organization's *basic underlying assumptions* are found. These are the elements of culture that are unseen and not cognitively identified

in every day interactions between organizational members. Additionally, these are the elements of culture which are often taboo to discuss inside the organization. Many of these "unspoken rules" exist without the conscious knowledge of the membership. Those with sufficient experience to understand this deepest level of organizational culture usually become acclimatized to its attributes over time, thus reinforcing the invisibility of their existence. Because cultures are learned by members of the organization, changing culture requires much discussion, communication, and learning and takes a long time to bring to fruition. Changing behaviors is also difficult because people have very strong "patterns" that they follow from habit.[2]

In summary, organizational culture is best defined by the shared basic assumptions that have developed in an organization over time as it learns from and copes with problems. Culture is the sum total of the organization's learning. The culture of a group is defined as: *a pattern of shared basic assumptions that was learned by the group as it solved its problems of external adaptation and internal integration that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems.*[3] In short, "it's the way we do things around here."

SAFETY CULTURE

It is vital that people's shared basic assumptions or beliefs are accurate and support safety. People can become very comfortable with the technology and the fact that "there hasn't been a major event here." Workers can come to believe (usually unconsciously) that their facility or system is robust—it has some safety margin. This mindset can be very dangerous. Assume for a moment that there is an operational hazard present in the system and there also exists this strong belief: the system is robust. This collective belief or assumption results in a lack of a sense of urgency about fixing defective equipment, so a physical barrier fails. Because the plant is robust, operators don't follow all the procedures, so the people barrier fails. Because the plant is robust, people fail to report minor problems or unusual observations, so the learning barrier fails. Finally, because the plant is robust, operators make non-conservative decisions in situations of uncertainty, and the "last chance" barrier fails—the outcome is an event.[4]

Because of the special characteristics and unique hazards associated with DOE research and defense operations, and the environmental restoration and D & D operations, associated organizations need to nurture a strong safety culture. It must be understood that safety is a collective responsibility in which everyone in the organization shoulders an obligation to ensure that it comes first.

There are several definitions of safety culture that apply to the DOE and its operations. Dr. Jonathan Wert[5] defines *Safety Culture* as "a work environment where a safety ethic permeates the organization and people's behavior focuses on accident prevention through critical self-assessment, pro-active identification of management and technical problems, and appropriate, timely, and effective resolution of the problems before they become crises." The British Health and Safety Commission defines *Safety Culture* as "the product of the individual and group values, attitudes, competencies, and patterns

of behavior that determine the commitment to, and the style and proficiency of, an organization's health and safety programs.

Safety culture is about good safety management established by organizations with a holistic, whole of community, whole of life approach. Good safety culture implies a constant assessment of the safety significance of events and issues so that the appropriate level of attention can be given. A strong safety culture is dependent first and foremost on the organization's ability to properly manage safety in the facility over time. Dr. James Reason advocates that three ingredients are absolutely vital for driving the safety culture—and they are the province of top management. These driving forces are *commitment, competence, and cognizance*—the three C's.

Commitment consists of motivation and resources. High levels of commitment are comparatively rare and hard to sustain. This is why the organization's safety culture is so important. Will the organization seek to be the model for good safety practices or simply be content to stay just ahead of the regulators? A good safety culture has to endure changes in senior management. It must provide the necessary driving force irregardless of who sits in the corner offices. The resources issue involves funding to achieve safety goals, but more pointedly it has to do with the caliber and status of the people assigned to direct the management of system safety.

Competence refers to the technical competence needed to achieve the safety goals. Paired comparison studies that examine pairs of companies matched in all respects except for safety performance have shown that the two characteristics most likely to distinguish safe organizations from less safe ones are (1) top-level commitment and (2) possession of an adequate safety information system. So, competence is closely related to the quality of the organization's safety information system. Does it collect the right information? Does it disseminate it? Does it act upon it?

Cognizance refers to the correct awareness of the dangers that threaten the facility's operations. Two features are common to organizations lacking the necessary level of cognizance. The first is where those at the top of the organization, possessing the largest degree of decisional autonomy, blame most of their safety problems on the personal shortcomings of those working at the sharp end. The second symptom is where managers treat safety measures like pieces of equipment. They put them in place, then tick them off as another job done. But safety measures have to be watched, worried about, tuned, and adjusted. Cognizant organizations understand the real nature of the "safety war." They see it for what it really is—a long guerilla struggle with no final conclusive victory.[6]

Reason's three C's needed to drive safety are supportive of the idea that a safety culture is a *leadership attitude that ensures a hazardous technology is managed ethically so individuals and the environment are not harmed.* Edgar Schein has said that ". . . one could argue that the only thing of real importance that leaders do is to create and manage culture. . . ." This section of the chapter addresses how leaders mold, influence, and sustain safety culture.

When people are tasked with a work assignment for which they lack specific guidance, they will defer to what they believe is the right thing to do. Often confronted with incorrect, incomplete, or inaccurate procedures or with equipment malfunctions,

inadequate tools, and the like, workers regularly have to make tradeoffs between productivity and protection. It is a normal human behavior to want to "get the job done" rather than taking the time to do the job safely due to overconfidence, underestimating risks, and so on. This is especially true when supervisors expect and reward the results and are silent about behaviors needed to stay safe. The reality is that in many organizations safety tends to be assumed, and not much is said about it.

Core values are the underlying set of beliefs and assumptions an individual deems most important for him or herself, the work group, or the organization. Values are necessary to help people with day-to-day decision making such as the dilemma noted above—an assignment with insufficient guidance. Values are embedded in the organizational culture. They are only helpful when they can be translated into concrete behaviors.[7] Managers must explicitly demonstrate to the workforce by their actions and behaviors that safety has to be preserved as a core value. Managing the culture requires conscious, careful consideration. Without the solidification and preservation of safety as a core value, managers will unconsciously reinforce getting the job done, with production becoming the default core value.[8]

Dr. Ron Westrum has identified three attributes of safety culture. The most critical issue for organizational safety is the flow of information. Westrum's idea was to characterize general ways of coping with information, especially information that suggests anomaly. Failures in information flow figure prominently in many major accidents, but information flow is also a type marker for organizational culture. In some organizations, information flows well and elicits prompt and appropriate responses. In others, it is hoarded for political reasons or it languishes due to bureaucratic barriers.

Westrum identifies three typical patterns that define how information flows within an organization. The first is characterized by a preoccupation with personal power, needs, and glory. The second is a preoccupation with rules, positions, and departmental turf. The third is a concentration on the mission itself, as opposed to concentration on persons or positions. These patterns are called respectively pathological, bureaucratic, and generative. These preferences create recognizable climates that affect the processing of information and other cognitive activities. The climate not only shapes communication, but also cooperation, innovation, and problem-solving. The table below describes how organizations process information.

How Organizations Process Information

Pathological	Bureaucratic	Generative
Power-oriented	Rule-oriented	Performance-oriented
Information is a personal resource to be used in a political power struggle. It will be withheld, doled out, or used as a weapon to advance particular parties within the organization. Messengers are shot, responsibilities are shirked. Cross-department bridging is discouraged. Faced with failure—scapegoating is standard.	Information tends to be stuck in the control stage. This type generates only modest cooperation. Messengers are neglected, standard channels or procedures are used for getting information to the right recipient (often too late to be useful). New ideas often present problems. Cross-department bridging is only tolerated. Faced with failure—seek justice	Encourage individuals to observe, to inquire, to make their conclusions known; and, where observations concern important aspects of the system, people are proactive in getting the information to the right people by any means necessary. Cross-department bridging is encouraged Faced with failure—inquiry into what is wrong

Patterns of information handling thus reflect the safety climate or culture. If leaders emphasize that information is to help accomplish the mission, then that use will predominate. If leaders emphasize that information must advance departmental goals, then that behavior will predominate. If leaders show through their behavior that information is only important as it advances or impedes their personal interests, then that use will predominate.[9]

Safety culture is the organization's values and behaviors—modeled by its leaders and internalized by its members—that serve to make operational safety the overriding priority. The strength of a facility's safety culture depends on the degree to which the employees internalize the attributes of safety. Even though the concept of safety culture is somewhat intangible, it is possible to reveal safety culture tendencies in our facilities by observing certain practices and behaviors.[10] The following principles are taken from the INPO publication *Principles for a Strong Safety Culture* (2004). These principles are likewise applicable to personnel in organizations working at DOE nuclear and non-nuclear facilities. In most instances, (exception being principle 5), the principle and supporting statements can apply when the word "nuclear" is omitted.

1. **Everyone is personally responsible for nuclear safety.** Responsibility and authority for nuclear safety are well defined and clearly understood. Reporting relationships, positional authority, staffing, and financial resources support nuclear safety responsibilities. Corporate policies emphasize the overriding importance of nuclear safety.

2. **Leaders demonstrate a commitment to safety.** Executive and senior managers are the leading advocates of nuclear safety and demonstrate their commitment both in word and action. The nuclear safety message is communicated frequently and consistently, occasionally as a stand-alone theme. Leaders throughout the nuclear organization set an example for safety.

3. **Trust permeates the organization.** A high level of trust permeates the organization, fostered, in part, through timely and accurate communication. There is a free flow of information in which issues are raised and addressed. Employees are informed of steps taken in response to their concerns.

4. **Decision-making reflects safety first.** Personnel are systematic and rigorous in making decisions that support safe, reliable facility operation. Operators possess the authority and understand the expectation to place the facility in a safe condition when faced with unexpected or uncertain conditions. Senior leaders support and reinforce conservative decisions.

5. **Nuclear technology is recognized as special and unique.** All decisions and actions take into account the special characteristics of nuclear technology. Reactivity control, core cooling continuity, and fission product barrier integrity are valued as essential, distinguishing attributes of the nuclear facility work environment.

6. **A questioning attitude is cultivated.** Individuals demonstrate a questioning attitude by challenging assumptions, investigating anomalies, and considering potential adverse consequences of planned actions. This attitude is shaped by an understanding that accidents often result from a series of decisions and actions that reflect flaws in the shared assumptions, values, and beliefs of the organization. All employees are watchful for conditions or activities that can have an undesirable effect on plant safety.

7. **Organizational learning is embraced.** Operating experience is highly valued, and the capacity to learn from experience is well developed. Training, self-assessments, corrective actions, and benchmarking are used to stimulate learning and improve performance.

8. **Nuclear safety undergoes constant examination.** Oversight is used to strengthen safety and improve performance. Nuclear safety is kept under constant scrutiny through a variety of monitoring techniques, some of which provide an independent perspective.

The responsibility for creating and nurturing a strong safety culture is squarely on the shoulders of line management. External entities such as consultants, advisory groups, oversight and assistance organizations, and others definitely can be influential in supporting a safety culture. Line management, nevertheless, has the sole obligation and accountability for safety culture.

LEADERSHIP

Fostering the principles for a strong safety culture is one of the most challenging tasks facing the facility management team. Leadership that is successful in achieving a

strong safety culture will most likely move a facility to the *next level* of human performance.[11]

> A leader is *any individual* who takes personal responsibility for his or her performance as well as the facility's performance *and* attempts to influence the improvement of the organization that supports that performance.

Human error and its consequences can occur anywhere and at anytime. Fortunately, most errors are trivial, having no consequence on the facility. But errors may challenge safety, and create dire consequences to the facility, its people, and the environment. Therefore, management must clearly understand how the organization influences people's behavior through shared values and the safety culture to get things done

Workers, supervisors, and managers must believe they can prevent human error and its consequences. The assumptions, values, and beliefs people cling to strongly influence the choices they make when they encounter unanticipated situations or when procedure direction is vague or absent. Influencing and managing these factors to encourage people to internalize the above principles is the central theme of leadership in human performance improvement. *Focusing on the station's shared assumptions, values, beliefs, and practices—the culture—is, perhaps, the most effective way to maximize the organization's resistance to events.*[12] A strong culture promotes long-term success of the facility. But culture is hard and slow to change. Focusing on performance, reducing errors and improving work processes is achievable in the short-run.

Leader's Role

The organization is the engine that drives the performance system (see the Performance Model in Chapter 3). This is achieved by directing and influencing human performance and insulating the job site and the performers with layers of defenses, barriers, controls, and safeguards. In the past, human performance consisted primarily of workers simply paying attention and doing the job right the first time. However, it is clear from years of accident research that a significant event presents unmistakable evidence of an organizational failure, not simple individual failure. Multiple defenses typically fail, contributing to the event's severity. Because it takes teamwork to suffer a significant event, it follows that managers, staff, supervisors, and workers have to work together to be free of events.

Balancing the competition for resources between production and prevention/safety presents a constant challenge to management. Therefore, the leader's role is to *align* organizational processes and values to optimize both production and safety at the job site.

Production and Prevention: Competing Purposes

Production and prevention (error and event) practices always compete in the minds of workers. Leaders have to work hard to keep the facility, environment, and personnel safe. Well-informed leadership at all levels of the organization will ensure that the vision, values, and beliefs (prevention-centered attributes) do not conflict with the mission, goals, and processes (production-centered attributes). Consistency and

alignment promote both production and prevention behaviors—together generating the desired long-term results.

Production behaviors are those actions or activities aimed toward meeting specific schedules to achieve mission objectives by producing a product within deadlines and budget considerations. The outcomes of production are self-evident—completing jobs on schedule, operating and maintaining equipment, generating products, minimizing expenses, and satisfying the customer.

Error-prevention behaviors, such as self-checking, peer-checking, reviews and approvals, and procedure use, *avoid* errors and events. Prevention behaviors require that people think, be "mindful," while executing prevention tactics. Production activities have to slow down long enough to allow people to think, while executing prevention tactics to prevent errors. In contrast to the noisy evidences of production behavior outcomes, the outcomes of prevention activities are the quiet non-events. There is no shouting, clapping of hands, exchanging "high fives," or staff parties. Following a near miss in the facility, people will express concern and will take part in discussions of the circumstances. Otherwise, workers do not generally comment or show emotion following a given period of safe operations. For this reason, it is relatively easy for workers to come to regard prevention activities as optional when they conflict with the accomplishment of production objectives.

Production behaviors naturally take precedence over prevention behaviors unless there is a strong safety culture—nurtured by strong leadership. Both production and prevention behaviors are necessary for long-term success. But sometimes managers err when they *assume* people will be are safe. Safety and prevention behaviors do not just happen. They are value-driven, and people may not choose the conservative approach because of the stronger production focus of their immediate supervision or work group. Therefore, *leadership is a defense.* A robust safety culture requires aggressive leadership that emphasizes the principles and attributes of a strong safety culture.[13] *Leadership is not optional.*

KEY LEADERSHIP PRACTICES

Five leader behaviors that promote excellence in human performance have been identified. Leaders act to influence both individual and organizational performance in order to achieve high levels of facility safety and performance through the following practices:[14]

- facilitate open communication;

- promote teamwork;

- reinforce desired behaviors;

- eliminate latent organizational weaknesses; and
- value error prevention.

Facilitate Open Communication

In many major accidents there was someone who knew something that if it had been communicated in time to the right people could have prevented the accident from taking place. It is this knowledge that reinforces the dictum that communication is the most effective defense against significant events.[15] Effective leaders work hard to root out any obstacles to communication. The organizational atmosphere must promote open, candid conversations about safety. Leaders, no matter what positions they hold, actively encourage others to identify error-likely situations and latent organizational weaknesses.

A safe atmosphere is cultivated when people treat each other with honesty, fairness, and respect—when they establish healthy relationships. An atmosphere of camaraderie, teamwork and collaboration motivates individuals to improve the effectiveness of the organization. Eventually, people become more willing to be held accountable and they seek assistance by admitting to and learning from errors.

If an individual believes his or her errors will be punished, then information related to those errors will likely remain obscure. In a *just* environment, the likelihood that a problem will be reported increases. High-performing organizations do not punish employees who make errors while trying to do the right thing.[16] Healthy organizations view error as an opportunity to learn.

Promote Teamwork

People have difficulty seeing their own errors, especially when they are working alone. Teamwork may improve the ability of individual team members to collectively prevent human performance problems. Because people are fallible, teamwork should make individual thinking and reasoning *visible* to the other members of the team. Dialogue between members of a team gives each one the opportunity to challenge assumptions and to detect team errors.

Accident research conducted in the aviation industry in the late 1970s showed repeatedly that failures in the cockpit to work as a team had devastating consequences. Sixty-six percent of air carrier, 79 percent of commuter, and 88 percent of general aviation accidents involved flight crew failures in interpersonal communications, decision-making, and leadership. In fact, more accidents were caused by these failures than by lack of technical flying skills.[17] These findings led the airlines to create training programs to improve teamwork in the cockpit. Key goals of the "Crew Resource Management" (CRM) training included the following, among others:

- teaching team members how to pool their intellectual resources;
- acquiring collective situation awareness that admits challenges from junior team members;
- improving communication skills; and
- emphasizing the importance of teamwork.

The behavioral characteristics important to the success of pilot performance on the flight deck from the CRM training were adopted in the nuclear power industry in the early 1990s, with the development of the Control Room Teamwork Development Course. The following attributes for improving teamwork, proven essential to pilot performance and control room operator performance are applicable to teams working at DOE facilities.

- **Ask Questions** – asking a series of questions to understand what is happening with the facility.

- **Advocate** – expressing a concern, position, or solution and making certain others understand what the individual knows.

- **Take Initiative** – taking the initiative to influence the behavior of others, especially when it comes to the condition of the physical plant (facility).

- **Manage Conflict** – resolving differences of opinion and getting all information on the table to reach the best solution; maintaining open communication channels among team members.

- **Critique Performance** – learning from experience, identifying what works well, and pinpointing what areas need improvement.

Reinforce Expectations

There is a direct cause-and-effect relationship between a manager's actions and an employee's behavior precisely because *behavior is motivated by its consequences.*[18] Consequences, far more than training, directives, or threats, reinforce behavior. People tend to seek and do things they like and avoid things they do not like.[19] This is a fundamental principle of human behavior. If people are to make a habit of applying human performance tools, then positive consequences must be associated with their behaviors.

Managers and leaders need to positively reinforce individuals who obtain value-added results through safe behaviors. Individuals who cut corners to get jobs done on schedule and under budget at the expense of quality and safety should be corrected, coached, or, perhaps, counseled. Consequences either keep the behavior going or stop it in the long term. Leaders should take time to understand and learn how to use reinforcement to promote targeted behaviors.

All behavior that is occurring in the facility now is the result of consequences that are also occurring now. Similarly, the organization is perfectly attuned to get the performance it is getting, right now. All behavior is reinforced. If at-risk behavior is common, it is because management has not made a difference with appropriate negative consequences. Behavior has four basic consequences.[20] The following model describes the effect consequences have on behavior.

Source: Daniels (1989).
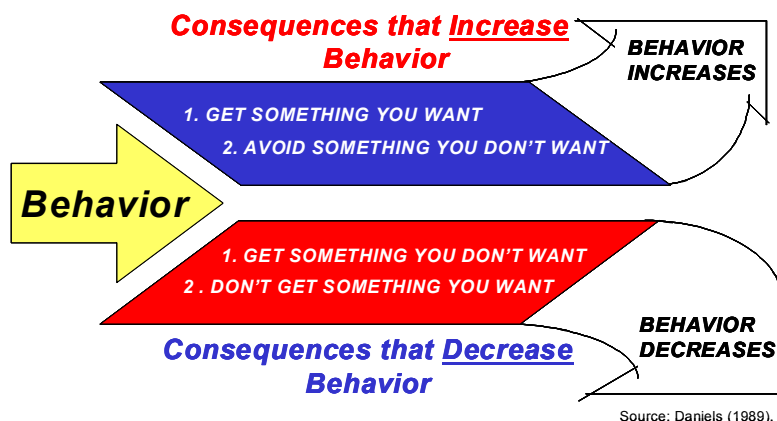
Used with permission from Aubrey Daniels, International.

The following consequences can be used to get the desired performance by targeting specific behaviors.

- **Positive Reinforcement – "**Get something you want" enhances the probability that the preferred behavior will recur and maximizes performance. This optimizes use of discretionary effort by the individual.

- **Negative Reinforcement –** "Avoid something you don't want" enhances the probability that the preferred behavior will recur, but only to meet the minimum standard.

  Note: Consequences that cause behavior to either increase or continue at a high standard are known as "reinforcers."

- **Punishment –** "Get something you don't want" reduces the probability that undesired behavior will recur if unwanted consequences are consistently coupled with the behavior. Punishment may also involve "losing something you don't want to lose"—a penalty. Sometimes this is necessary to get the new expectation started for an individual. However, it should not be used for the long term.

- **Extinction –** "Don't get something you want" reduces the probability that undesired behavior recurs, since nothing happens when that behavior occurs. Usually, the behavior eventually disappears after several repeated attempts.

Training, procedure direction, incentives, reminders from supervisors or peers, administrative policies, and expectations precede and set the stage for individual performance. These preexisting elements have more strength when they (a) specify the behavior, (b) specify whom, (c) occur at the right moment (just in time), and (d) imply the consequences.[21] The consequences in terms of reinforcers and incentives need to be determined for desired behavior. Expectations need positive reinforcers, while unacceptable behaviors need penalties—disincentives—or the elimination of positive reinforcers that motivate unsafe or at-risk practices. Any punishments or penalties existent in the system also need to be eliminated for expected practices. Positive reinforcers are more effective if they are *positive* for the individual, *immediate*

with respect to when the behavior occurs, and *certain*. Penalties are stronger if the consequence is negative, immediate, and certain for the individual concerned.[22]

Eliminate Latent Organizational Weaknesses

Organizational weaknesses show up as vulnerabilities, flaws, and defects in controls and defenses (engineered, administrative, cultural, and oversight controls). Methodically searching for and eliminating latent organizational weaknesses eliminates factors that contribute to significant events. Chapter 4 describes several methods of finding latent organizational weaknesses, which are listed here for reference:

- self assessments
- trending
- operating experience
- behavior observations
- problem (causal) analysis

- surveys and questionnaires
- corrective action program

- performance indicators
- benchmarking
- independent oversight
- problem reporting
- management oversight, involvement and reinforcement

- event investigation

The use of a systematic diagnostic approach for discovering recurring individual or work group performance problems provides another means of identifying organizational weaknesses. Managers and supervisors need a tool that helps them develop a clear understanding of a performance discrepancy and why it is happening. With the aid of the Behavior Engineering Model (BEM-D) discussed below, performance analysis helps define the performance gap by contrasting current performance with desired performance and systematically identifying the factors that contribute to the performance gap. Once valid reasons for the performance gap are understood, the manager or supervisor can develop more effective and efficient corrective actions. A sample *Performance Gap Analysis* form is provided in Appendix A to help in the analysis and solution to human performance problems. Starting with a known performance problem, the user(s) searches for answers to a series of questions that help in determining the performance discrepancy and selecting potential corrective actions.

- what is the performance problem
- Is the problem worth solving?
- Is there clear direction to perform as desired?
- Are there appropriate consequences for performance (behavior)?
- Do the workers already know how? (Could they do it if their lives depended on it)?
- Are there other obstacles to desired performance?

Value the Prevention of Error

People's beliefs and attitudes toward hazards and error traps affect their adherence to high standards. If error-free performance (avoiding active errors) is **not** held up as an important value or is not expected for daily work; then people may adopt unsafe practices to get their work done; possibly placing themselves, others, or the facility at risk of an event. Consistently maintaining high standards communicates the value of error prevention. By clinging to high standards regardless of the perceived risk, adherence to expectations will become the norm.

Positive attitudes about error prevention depend greatly on what is rewarded and which behaviors are reinforced. It is easier to change behavior when positive attitudes exist. Positive values and attitudes follow behaviors that consistently result in success for the individual. It is not necessary for values and attitudes to precede behavior, but it is preferable.

The most effective way to communicate values is to act in accordance with them while reinforcing people when they apply them.[23] The following leader behaviors convey the values of the organization, in order of influence:[24]

- what managers pay attention to, measure, and control;

- reactions to critical incidents or crisis;

- allocation of resources;

- deliberate attempts to coach or role model;

- criteria for allocation of rewards and punishment; and

- criteria for selection, advancement, and termination.

If those in positions of responsibility and influence react appropriately, with integrity, and consistent with stated values, people will adopt safe behaviors.


BEHAVIOR ENGINEERING MODEL-D (BEM-D)

The Behavior Engineering Model is an organized structure for identifying potential factors that impact performance at the job site and for analyzing the organizational factor contributors to those factors. As previously stated, job-site conditions that affect behavior can be categorized into two types of variables: (1) the *environment* and (2) the *individual*. Environmental factors include conditions external to the individual; individual factors include internal conditions generally under the person's control. However, some aspects of human nature, such as stress, instinctive reflexes, and mental biases, are not always controllable.

The BEM-D specifies those factors relevant to the individual performer and the environment in which the person performs. The BEM is denoted with the letter "D" for DOE, because this version is an adaptation of the original BEM from Tom Gilbert's

book *Human Competence, Engineering Worthy Performance* (1978). The BEM-D is
illustrated in two tables on pages 33 and 34.

In reference to headings on the BEM-D table, prior conditions that stimulate behavior—
direction to act—include directives, knowledge, or cues that inform or prompt a person
to act. Job-site conditions that set the occasion for behavior—*opportunity to act*—
include those factors that make action achievable or realizable. And conditions that
tend to reinforce the act—*willingness to act*—are shaped by the match of the
individual's motives with the incentives associated with the job or task. These
categories attempt to describe the "stimulus-response" components of human
behavior.[25]

Strategically, environmental factors provide the greatest leverage in terms of potential
for improving human performance. Leverage and cost are important factors to
consider when determining corrective actions. Think back to the *Anatomy of an Event*.
It is estimated that 85 percent or more of the causes of facility events have their origins
in the processes and culture of the organization. Changes in environmental factors
offer greater impact at less expense on performance improvement than changes at the
individual level.[26] For example, if the causes of a performance problem point to
individual factors (motives, capacity/readiness, and knowledge and skills),
implementation of corrective actions would have less immediate influence and the cost
in generating the desired improvement will likely be greater.[27]
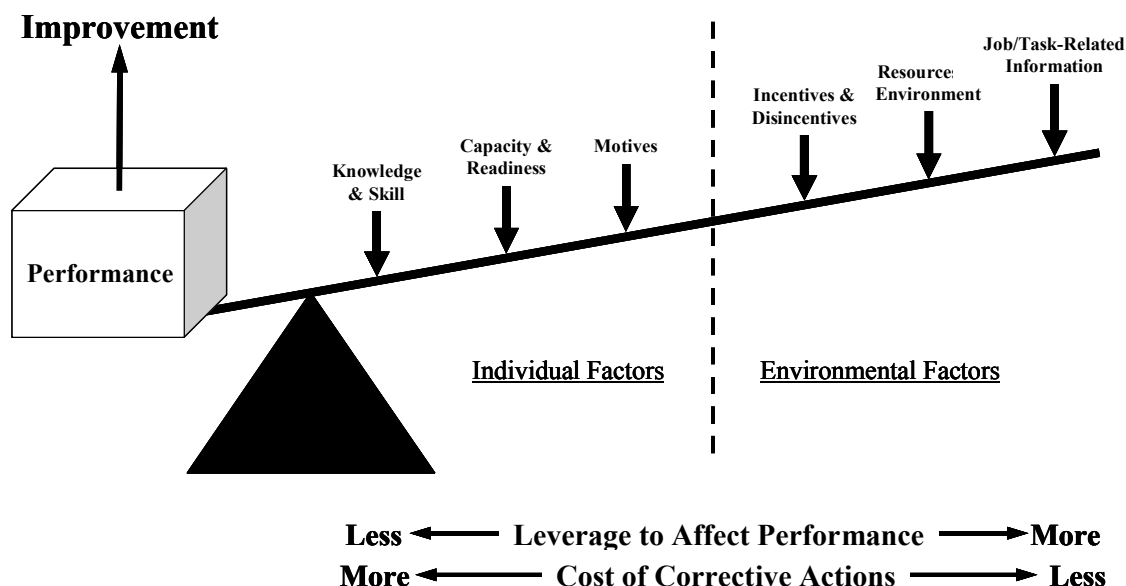
The BEM-D is illustrated in the following tables. The first describes those job-site
conditions that are relevant to the performer's work environment and the second

describes conditions relevant to the individual. Deficiencies with the numbered items can create error-likely situations for the individual during the task at hand.

	Direction to Act	Opportunity to Act	Willingness to Act
	Job or Task-Related Information (requirements / guidance on what one is supposed to do and how well)	**Resources and Environment** (external conditions affecting performance of the job or task)	**Incentives and Disincentives** (an environment of rewards and sanctions explicitly or implicitly associated with the job or task)
Environmental Factors	1. Job or task goals, desired results, roles and responsibilities, and criteria for success are clearly identified. 2. The risk importance of the job or task and critical steps, if any, have been denoted and communicated as such. 3. Clear expectations and standards for the conduct of work exist and have been communicated. 4. The usability, accuracy, and availability of procedures support error-free performance. 5. Relevant feedback on previous job or task performance, including opportunities for development, has been given to the individual (if applicable).	1. Tools, material, clothing, furniture, facilities, systems, and equipment accommodate human limitations and are available and accessible. 2. Other individuals or organizations are available for support, if needed. 3. Adequate time is allotted, and other work conditions that could hinder performance are eliminated or minimized. 4. The values, attitudes, and beliefs of the person's immediate work group about hazards in the workplace support safe practices.	1. Financial and non-financial rewards and disincentives are contingent on performance. 2. Competing incentives for poor performance are eliminated. 3. The job or task provides opportunities for success and career advancement, meets employee needs, and results in identifiable pieces of work traceable to the individual. 4. People are treated with honesty, fairness, and respect regardless of position in the organization. 5. Work group standards are consistent with the above.

	Direction to Act	Opportunity to Act	Willingness to Act
Environmental Factors	**Relevant Error Precursors:** • simultaneous, multiple tasks • repetitive actions; monotonous • irreversible actions • interpretation demands • unclear goals, roles, and responsibilities • lack of or unclear standards • confusing procedure or vague guidance • unclear strategic vision • meaningless rules • excessive communication requirements • delays or idle time • long-term monitoring	**Relevant Error Precursors:** • time pressure • distractions / interruptions • changes / departures from routine • confusing displays or controls • identical and adjacent displays or controls • workarounds • OOS$^\phi$ instrumentation or warning systems • hidden equipment response • unexpected equipment conditions • lack of alternative indication • complexity • unavailable tools, parts, etc. • high data flow • back shift / recent shift change • adverse physical climate / habitability • conflicting conventions; stereotypes • backshift; recent shift change • poor equipment layout / access • nuisance alarms • equipment sensitivity to vibration	**Relevant Error Precursors:** • high workload • fear of consequences of mistakes • production overemphasis • personality conflict • excessive time on task • repetitive actions / monotony • mistrust among coworkers / work groups • regular use of at-risk practices • excessive time on task • excessive group cohesiveness / peer pressure • no accounting of performance • acceptability of "cook-booking"

	Direction to Act	Opportunity to Act	Willingness to Act
	Knowledge and Skills (basic/specialized understanding of concepts, theories, system construction, fundamentals, and skills)	**Capacity and Readiness** (physical, mental, and emotional factors influencing individual's ability / capacity to perform a job or task)	**Personal Motives** (intrinsic & induced motivation related to an individual's needs for achievement, affiliation, security, and control)
Individual Factors	1. Individual is qualified for the job or task and possesses the knowledge, skills, experience, and proficiency necessary to perform the task successfully. 2. Individual understands the job or task objective(s), critical steps, and potential consequences if performed improperly. 3. Individual understands the roles and responsibilities of others.	1. Individual possesses the intelligence, sociability, aptitude, size, strength, and dexterity to perform the job or task successfully. 2. Individual is available for work, undistracted, and fit for duty.	1. Individual cares about performing the job or task well. 2. Individual possesses a healthy work ethic and is willing to do what is right regardless of what others would do. 3. Individual feels that the job or task is meaningful and attainable, progress is recognizable, and the task generates a personal sense of accomplishment.

|	**Direction to Act**	**Opportunity to Act**	**Willingness to Act**
Individual Factors	**Relevant Error precursors**: • unfamiliarity with task • first time with task • new technique not used before • lack of proficiency • lack of experience • imprecise communication habits • indistinct problem-solving skills • unaware of critical parameters • tunnel vision (lack of big picture)	**Relevant Error precursors**: • stress • habit patterns • assumptions • complacency or overconfidence • mind set • Pollyanna risk perception • mental shortcuts (biases) • limited short-term memory; attention span • limited perspective (bounded rationality) • illness or fatigue • anxiety • poor teamwork skills • major life event • sugar cycle (after a meal) • poor manual dexterity • low self-esteem; moody • physical reflex or imprecise physical action • physical size too large or small for task • human variability • spatial disorientation	**Relevant Error precursors:** • production, "get-r-done" mindset • willingness to sidestep the rules for personal gain • "unsafe" attitude toward critical steps • questionable ethics • boredom • fear of failure / consequences • excessive professional courtesy • excessive group cohesiveness • social deference • no sense of control / learned helplessness • avoidance of mental strain

The BEM-D can serve as an analysis tool for evaluating human error and related performance problems, providing a framework for exposing the real root causes that originate within the organization.

The BEM-D contains many of the factors—good and bad—that influence human performance, including *error precursors*. The BEM-D is included here to show that error precursors, like other job-site conditions, are the result of organizational processes and values. In each case, one or more aspects of the organization that establish a job-site condition or error precursor can be identified. For instance, an individual's level of knowledge is likely an outcome of the organization's training program, or the human resources selection process may have overlooked required abilities necessary for the task at hand.[28]

CREATE A JUST CULTURE

The Blame Cycle

The "blame cycle" is urged on by the belief that human error occurs because people are not properly motivated.[29] In reality, no matter how motivated an individual is, active errors will continue to occur, occasionally. Events will continue as long as event investigations stop prematurely at the active human error. The true causes (typically organizational weaknesses) will not be discovered—will remain latent or hidden—and errors and events will persist.
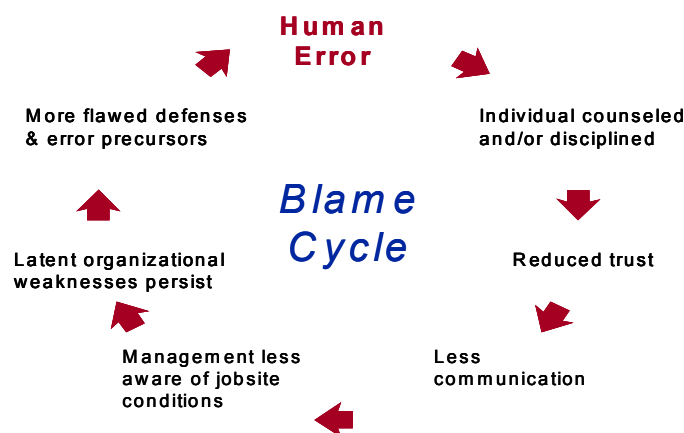
Categories of Violations

It is important to recognize that there are at least two major categories of violations—*routine and thrill-seeking or optimizing*. Routine violations typically involve corner-cutting at the skill-based level of performance by taking the path of least effort between two task-related points. These shortcuts can become a habitual part of a person's behavior, particularly when the work environment is one that rarely sanctions violations or rewards compliance. Routine violations are also prompted by "clumsy" procedures that direct actions along what seems to be a longer-than-necessary pathway.[30] Routine violations are not necessarily reckless. Routine violations often look like latent weaknesses.

Thrill-seeking or optimizing violations are violations "for the thrill of it." Thrill-seeking violations reflect that human actions serve a variety of motivational goals and that some of these are quite unrelated to the functional aspects of the task. These violations are committed to appear macho, to avoid boredom, or simply for kicks. This category of violation is reckless.

 In some organizations employees are named, blamed, shamed, and re-trained based on the consequence of their action, not the intent of the action. If either the violation or error they committed caused an accident or a mishap of some kind, they are disciplined, but the very same actions (both violations and errors) without a consequence, are ignored or allowed to slide. In some organizations people are allowed to commit violations right along until there is an event, then all hell breaks loose. What this means is that someone who inadvertently errs is held accountable for their actions in the same fashion that someone who intentionally performs work he or she knows is contrary to known standards.

A just environment is all about getting the balance right between how willful violations and unintentional errors are addressed in the organization. All too often organizations do not make clear the distinctions between errors and violations. A just organization clears the smoke in the air between erring and violating. To do so, management sets a zero tolerance policy for reckless conduct—bad acts we call violations. Zero tolerance for violations is balanced by the belief and the widespread confidence among the leadership that the vast majority of unintended unsafe acts will go unpunished as honest errors—unintended departures from expected behavior—on the part of the performer. There are proven methods to help organizations determine culpability for serious incidences in which unsafe acts are involved.

The Foresight Test

The question to ask is: "Did the individual knowingly engage in behavior that the average individual in the work group would recognize as being likely to increase the probability of making a safety-critical error?" If the individual's peers respond that they would have recognized the action as promoting an error, then it is likely the individual in question should also have recognized the same thing. If the peers failed to see the connection between the action taken and increased risk, then it is reasonable to assume that the individual also did not see the connection. In any one of the following situations, however, the answer to this question is likely "yes" and as such is indicative of culpability:

- performing work under the influence of a drug or substance known to impair performance;

- clowning around while driving a towing vehicle or forklift truck or while handling other potentially damaging equipment;

- taking unwarranted shortcuts like signing off on jobs before they are completed; and

- using tools, equipment, or parts known to be sub=standard or inappropriate.[31]
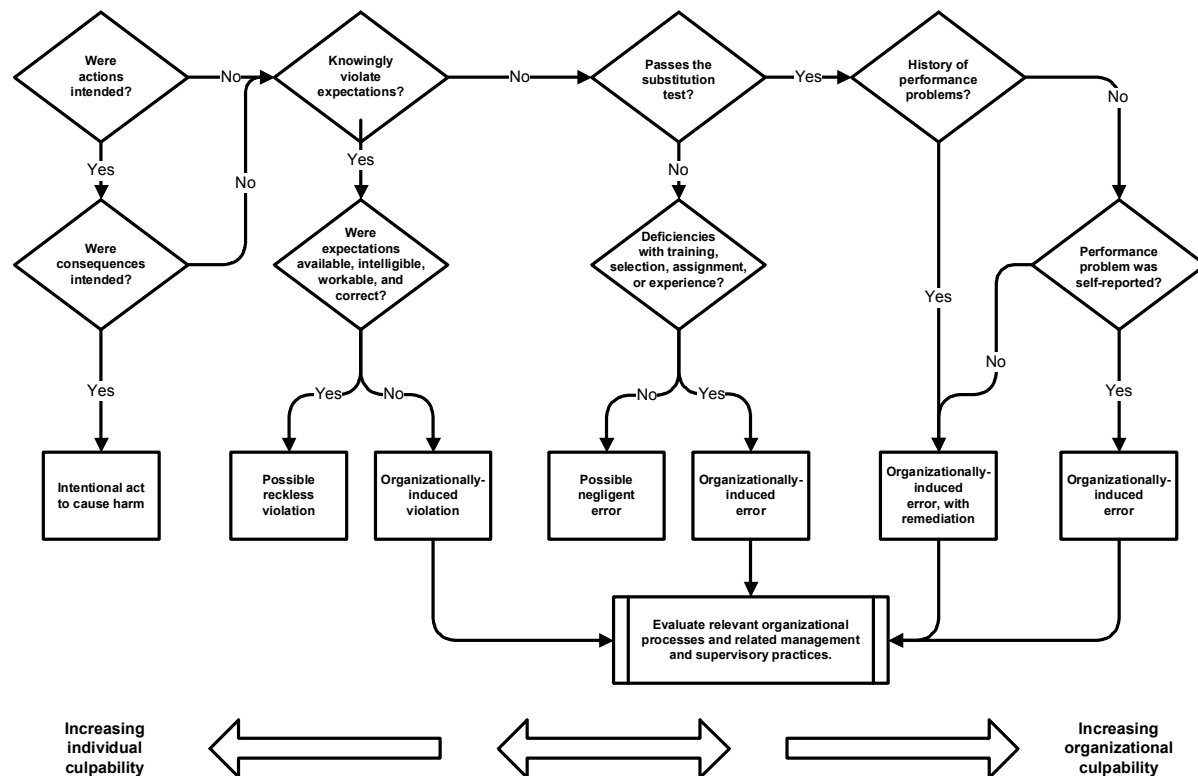
Keep in mind the Foresight Test is a "rule of thumb" measure. There will likely also be extenuating circumstances associated with any of these situations.

The Substitution Test

This test is in keeping with the principle that the best people can make the worst errors. This exercise involves substituting the individual concerned in the event with other individuals who do the same kind of work and who have comparable training and experience. Then the question is asked: "In light of how events unfolded and were perceived by those involved in real time, is it likely a different person with similar skills and training would have behaved any differently?" If the answer repeatedly comes back from the selected peers, "probably not," then apportioning blame has no place here and would likely obscure the underlying systemic deficiencies. Another way to use the substitution test is to ask the question in a different way of a small number of the erring individual's work mates: "Given the circumstances that prevailed at the time, could you be sure that you would not have committed the same or a similar type of unsafe act?" If the response is "probably not," then blame is very likely to be inappropriate. It is a "blameless" error."[32] The substitution test is often used in conjunction with the Culpability Decision Tree, which is discussed below.

The Culpability Decision Tree

The logic diagram below is a proven management tool intended to help determine the culpability level of an individual in response to events or near misses triggered by human error.[33] When used in conjunction with the organization's accountability policy, the tool supports the fair and consistent application of disciplinary outcomes across all departments and work groups. An explanation of how to make use of the Culpability Decision Tree is provided in Appendix B. The tool is an adaptation of Dr. James Reason's Culpability Decision Tree in his book, *Managing the Risks of Organizational Accidents*, which provides further in-depth description of the use of the diagram.

Decision flowchart:

- Were actions intended? — No → Knowingly violate expectations?
- Were actions intended? — Yes → Were consequences intended?
- Were consequences intended? — Yes → **Intentional act to cause harm**
- Were consequences intended? — No → (to Knowingly violate expectations?)

- Knowingly violate expectations? — No → Passes the substitution test?
- Knowingly violate expectations? — Yes → Were expectations available, intelligible, workable, and correct?
- Were expectations available, intelligible, workable, and correct? — Yes → **Possible reckless violation**
- Were expectations available, intelligible, workable, and correct? — No → **Organizationally-induced violation**

- Passes the substitution test? — No → Deficiencies with training, selection, assignment, or experience?
- Passes the substitution test? — Yes → History of performance problems?
- Deficiencies with training, selection, assignment, or experience? — No → **Possible negligent error**
- Deficiencies with training, selection, assignment, or experience? — Yes → **Organizationally-induced error**

- History of performance problems? — Yes → **Organizationally-induced error, with remediation**
- History of performance problems? — No → Performance problem was self-reported?
- Performance problem was self-reported? — No → (to remediation)
- Performance problem was self-reported? — Yes → **Organizationally-induced error**

Organizationally-induced violation, **Organizationally-induced error**, **Organizationally-induced error, with remediation**, **Organizationally-induced error** → **Evaluate relevant organizational processes and related management and supervisory practices.**

Increasing individual culpability ⇐⇒ Increasing organizational culpability

Adapted with permission from Dr. James Reason's *Managing the Risks of Organizational Accidents*, Ashgate Publishing Limited, 1997.

When an event is initiated by an *honest* error, as determined by one or more of the tools described above, the entire system that supports the performance in question should be evaluated (see "systems-thinking" in Chapter 3). Events triggered by human error are often symptomatic of a *system failure*. Instead of asking how the individual failed the organization, the question "how did the organization fail the individual?" would be more appropriate. In addition to the individual, what or who could have *prevented* the event? What flaws or oversights in work processes, policies, or procedures contributed, promoted, or allowed the error and event to occur? Because the majority of the causes of events originate in the system of controls, processes, and values established by the management team, management's first reaction to events should be to look within the organization.

A just culture is a prerequisite for a reporting culture. Useful tips for establishing a reporting culture appear in Appendix C.

ATTACHMENT A – PERFORMANCE GAP ANALYSIS⁺

What is the performance problem?	a. What is currently happening?	
	b. What should be happening (desired performance)?	
Is the problem worth solving?	a. Does the problem affect plant performance or personnel safety?	Yes ☐ No ☐
	b. What is the potential cost or consequence of doing nothing?	Yes ☐ No ☐
1. Is there clear direction to perform as desired?	a. Are expectations, standards, priorities, roles, and responsibilities clear and understood by the performer(s)?	Yes ☐ No ☐
	b. Are resources, tools, equipment, and other assistance available and adequate?	Yes ☐ No ☐
	c. Are work documents accurate, do they contain sufficient detail, and are they usable for the performer(s)?	Yes ☐ No ☐
	d. Does the individual(s) get visible, objective feedback on the quality of work?	Yes ☐ No ☐
	e. Is the risk significance of the job/task clearly stated?	Yes ☐ No ☐
	f. Are there conflicts in direction and standards (between procedures, supervisors and managers, departments, and so forth)?	Yes ☐ No ☐
2. Are there appropriate consequences for performance (behavior)?	a. Is the desired performance punishing to the performer (more work, delays, anxiety, ridicule, fatigue, and so forth)?	Yes ☐ No ☐
	b. Is current performance rewarding to the performer?	Yes ☐ No ☐
	c. Does the performer experience positive consequences for good performance? (If yes, are they immediate and certain?)	Yes ☐ No ☐

3. Do they already know how? (Could they do it if their lives depended on it?)	a. Is the performer(s) qualified and has he/she done it properly before? (If yes, knowledge and skills are probably satisfactory.)	Yes ☐ No ☐
	b. Are the tasks performed often enough to maintain proficiency? (If yes, see 3.D. If no, then provide opportunities to practice.)	Yes ☐ No ☐
4. Are there other obstacles to desired performance?	a. Are there personal problems beyond the performer's control that hinder desired performance (such as FFD, medical, family issues, physical limitations)?	Yes ☐ No ☐
	b. Are ergonomic challenges present in the workplace for example, workarounds and problems with labeling, habitability, equipment accessibility, clothing, PPE, and human-machine interface)?	Yes ☐ No ☐
	d. Are there inappropriate distractions or interruptions in the workplace?	Yes ☐ No ☐
	e. Is the task or process too complex?	Yes ☐ No ☐
	f. Are there obstacles to communication between the performer(s) and supervision?	Yes ☐ No ☐
	g. Are job/task performance requirements beyond the performer's capabilities (such as fatigue, sleep decrement, strength, dexterity, and color blindness)?	Yes ☐ No ☐
	h. Does desired performance matter to the performer(s) (for example, unsafe attitudes, morale, work ethic, self-esteem, and peer pressure)?	Yes ☐ No ☐
5. Identify valid reasons for performance discrepancy.	Reasons:	
6. Select potential corrective actions.	Solutions:	

ATTACHMENT B – CULPABILITY DECISION TREE

Start with the assumption that the actions under scrutiny have contributed either to an accident or to a serious incident in which a bad outcome was only just averted. In an organizational accident, there are likely to be a number of different unsafe acts. The decision tree should be applied separately to each of them. The concern here is with individual unsafe acts committed by either a single person or by different people at various points in the accident sequence. Because of the subjectivity of the questions the Decision Tree should be used by a small team or committee vise a single manager or supervisor.

The questions of the inquiry relate primarily to intention. Unintended actions define slips and lapses, in general, the least blameworthy of errors. Unintended consequences cover mistakes and violations. The decision tree usually treats the various error types in the same way, except with regard to the violations question.

Start at the top left box on the logic diagram. The numbers below relate to the boxes left to right

Were the actions as intended? The key questions relate primarily to intention. If both the actions and the consequences were intended, then we are likely to be in the realm of criminal behavior, which is probably beyond the scope of the organization to deal with internally. Unintended actions define slops and lapses—in general, the least blameworthy of errors—while unintended consequences cover mistakes and violations.

1. **Knowingly violating expectations?** If the individual was knowingly engaged in violating expectations at that time, then the resulting error is more culpable since it should have been realized that violating increases both the likelihood of making an error and the chances of bad consequences resulting. Violations involve a conscious decision on the part of the perpetrator to break or bend the rules (except when noncompliance has become a largely automatic way of working). Although the actions may be deliberate, the possible bad consequences are not—in contrast to sabotage in which both the act and the consequences are intended. Most violations will be non-malevolent in terms of intent; therefore, the degree to which they are blameworthy will depend largely on the quality and availability of the relevant procedures.

   Procedures are not always appropriate for the particular situation. Where this is judged to be the case (perhaps by a "jury'" of the perpetrator's peers), the problem lies more with the system than with the individual. But, when good procedures are readily accessible but deliberately violated, the question then arises as to whether the behavior was reckless in the legal sense of the term. Such actions are clearly more culpable than "necessary: violations—the non-compliant actions necessary to get the job done when the relevant procedures are wrong or inappropriate or unworkable.

2. **Passes the substitution test?** The "substitution test," or something similar, is used to help in judging the culpability of organizationally induced violations. Could some well-motivated, equally competent, and similarly qualified individual make the same kind of error under those or very similar circumstances? If the

answer provided by a jury of peers is "yes," then the error is probably blameless. If the answer is "no," then we have to consider whether there were any system-induced deficiencies in the person's training, selection, or experience. If such latent conditions are not identified, then the possibility of a negligent error has to be considered. If they are found, it is likely that the unsafe act was a largely blameless system-induced error.

3. **History of performance problems?** Keep in mind that people vary widely and consistently in their liability to everyday slips and lapses. Some individuals, for example, are considerably more absentminded than others. If the person in question has a previous history of unsafe acts, it does not necessarily bear upon the culpability of the error committed on this particular occasion, but it does indicate the necessity for corrective training or even career counseling along the lines of "Don't you think you would be doing everyone a favor if you considered taking on some other job within the company?" Although absentmindedness has nothing at all to do with ability or intelligence, it is not a desirable trait in a pilot, a control room operator, a physician, or the like.

The line between acceptable and unacceptable behavior is more clear when the logic diagram is used. An intentional act to cause harm (lower left) is wholly unacceptable and should receive very severe sanctions, possibly administered by the courts rather than the organization. Knowingly violating expectations that were workable likely suggests reckless violation, a condition that warrants sanctions. The remaining categories should be thought of as blameless—unless they involve aggravating factors not considered here. Experience suggests that the majority of unsafe acts—perhaps 90 percent or more—fall into the blameless category.[34]

APPENDIX C – ESTABLISHING A REPORTING CULTURE

It cannot be assumed that once a just environment is in place workers will naturally begin to report problems, mishaps, and errors. There are a number of organizational, as well as psychological, barriers that must be hurdled before a reporting culture can be put in place. The first barrier to overcome is a natural disinclination to confess one's blunders—no one wants to be held up to ridicule. The second barrier is the suspicion that such reports might go on the record and count against them in the future. The third is skepticism. People reason that if they go to the trouble of writing an event report that reveals system weaknesses, how will they be sure that management will act to improve matters? Fourth, actually writing the report takes time and effort, and many people conclude, "why bother?".

Following are some features of successful reporting programs. Each feature is designed to overcome one or more of the barriers noted above.

- *De-identification.* How this is achieved depends on the culture of the organization. In some organizations there is complete anonymity. Elsewhere organizations are content with confidentiality, wherein the person reporting is known only to a very few people.

- *Protection.* A very senior manager issues a statement guaranteeing that anyone who reports will receive at least partial indemnity against disciplinary procedures. Because some acts are culpable, it is not feasible to offer complete immunity from sanctions. Experience from successful programs indicates that circumscribed guarantees are sufficient to elicit large number of reports of honest errors.

- *Separation of functions.* Successful programs organizationally separate the functions of collecting and analyzing the reports from the authority to initiate disciplinary proceedings.

- *Feedback.* Rapid, useful, accessible, and intelligible feedback to the reporting community is essential to overcome any perception that reports were going into a black hole. This may be achieved by publishing summary reports of the issues raised and the measures that have been implemented.

- *Ease of making the report.* Experience shows that people prefer responding to a reporting style that allows them to tell a story and express their own perceptions and judgments, as opposed to having to force-fit responses into a highly structured pre-programmed format. [35]

The greatest value of a safety information system lies in its ability to identify recurrent event patterns, error traps, and gaps or weaknesses in the defenses. Reporting systems are usually coupled with corrective action programs wherein identified problems in the field are researched and plans are devised and actions carried out to eliminate the problem and prevent recurrence. A primary objective of acquiring this safety information is to help the organization (workers, leaders, and management) learn from past near misses, mistakes, and inconsequential errors.

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